

Engagement Opportunities in NASA STEM 2023 (EONS-2023)
NASA Research Announcement (NRA)
MUREP Space Technology Artemis Research (M-STAR)
Number: NNH23ZHA001N-MSTAR

Title: Rotating Detonation Rocket Engines for In-Space Propulsion: Integrating Technology Development with STEM Engagement

Institution: University of Texas, Arlington

City/State: Arlington, TX

PI: Liwei Zhang

FY: 2023

Summary: As revolutionary propulsion systems, detonation-based engines have theoretical advantages over conventional deflagration-based systems, but their capabilities and limitations must be further investigated for in-space propulsion. To address NASA STMD strategic thrust “Go: Rapid, Safe, and Efficient Space Transportation”, the PI and Co-Is are proposing to examine and improve the component-level and system-level performance of rotating detonation engines over a wide range of operating pressures and nozzle backpressures, mimicking the in-space environment of liquid-propellant rocket engine systems. An intensive and synergistic integration of analytical, numerical, and experimental efforts will be employed to examine the injector, combustor, nozzle, and the connected system of rotating detonation rocket engines (RDREs). Geometric parameters and operating conditions will be evaluated and adjusted to increase RDRE efficiency and operability.

The University of Texas at Arlington (UTA) is a Hispanic Serving Institution and Asian American Native American Pacific Islander-Serving Institute designated by the United States Department of Education. As a Carnegie R1 institution and the fourth university in the state to receive the coveted Texas Tier One designation, UTA is dedicated to conducting cutting-edge research, engaging with the community at large on issues of critical importance, and promoting opportunities for diverse engagement. In the proposed work, the PI and Co-Is will also address NASA M-STAR’s “Goal 3: Strengthen participation of faculty, researchers, and students at MSIs in the research programs of the NASA STMD” and “Goal 4: Facilitate mechanisms to ensure that the diversity of workers at NASA, and in undergraduate and graduate degrees awarded to students from MSIs in aerospace-related fields, reflect the diversity of our nation”. The proposed education program will promote participation and engagement of minority students from diverse backgrounds in space related fields through dedicated outreach activities, undergraduate research opportunities, social media campaign, service-learning programs, and intervention strategies rooted in social science research. As one of the first collaborative projects between social science and propulsion education, it is anticipated that the proposed efforts will shed light on minority-student education and provide effective practices to recruit, retain, promote, and empower them in the space workforce.

During the proposal period, research teams from the Department of Mechanical and Aerospace Engineering in the College of Engineering and the Department of Communication in the College of Liberal Arts at UTA will form a close coalition to achieve the goals. The proposal team will implement a set of research and educational activities on and off UTA's campus and collaborate with NASA Centers/JPL, space companies, and non-profit organizations. UTA has the mission of the advancement of knowledge and the pursuit of excellence, and one of its core values is Inclusiveness and Diversity. The success of this proposal will enhance the research capacity and capability of the investigators and their affiliated programs at UTA. Located in the center of the Dallas-Fort Worth metroplex, UTA has an amiable campus culture and outstanding records in supporting minority populations. This NASA partnership will help UTA establish a hub that prepares a diverse body of students and researchers for the space workforce and collaborates with NASA STMD programs among NASA Centers/JPL.